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ABSTRACT

This paper applies a probit estimation to assess the relationship between economic takeoffs during 1950-2000 and inflows of portfolio debt, portfolio equity, and FDI, controlling for country's stock of short-term external debt and commodity terms of trade. Average level of FDI inflows is associated with a 23 percent higher takeoff probability relative to a zero FDI inflow benchmark, and this effect is highest for the Latin America subsample, with a 65 rise in takeoff probability. Higher stock of short term external debt has been associated with a substantial negative effect on the probability of a takeoff, and the effect of the short terms debt overhang is largest for Latin American countries. Yet, virtually all the takeoffs were associated with a rise in portfolio debt inflows. At the sample mean, inflow of portfolio debt is associated with approximately 25 percent higher probability of a takeoff. In contrast, a one standard deviation increase in equity outflows (inflows) is associated with a 47 percent (17 percent) decline in the probability of a takeoff. A one standard deviation improvement in commodity terms of trade is associated with 28 percent higher takeoff probability.

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1 Introduction

The large swings of financial flows between the OECD and emerging countries in the 2000s, and the growth turbulences associated with the financial crisis of 2008-9 put to the forefront the association between growth takeoffs and the revealed patterns of financial integration. The renewed post-crisis large inflows of hot money to emerging and developing countries focused attention on the degree to which these flows would affect down the road the growth prospects of developing countries. For instance, Canuto (2010) describes various dangers from asset price overshooting caused by excessive foreign investor demand for emerging markets' stocks, bonds, real estate, and other financial assets. Furthermore, the heightened volatility of commodity prices renewed concerns about the greater exposure of developing countries to adverse consequences of commodity terms of trade deterioration[1], as a given change in the relative prices of commodities tends to induce a much larger income effect in poorer countries.

The growing global weight of emerging-market economics, and the growing gaps between non-emerging developing and the emerging market countries propagated significant literature on conditions conducive to growth acceleration and economic takeoffs [see Hausmann, Pritchett, and Rodrik (2005) and Aizenman and Spiegel (2010), and the references therein]. This paper focuses on narrow two key questions related to the future growth prospects of developing countries -- the marginal association between portfolio debt, portfolio equity, and FDI flows patterns and subsequent economic takeoffs; the marginal association between commodity terms of trade shocks and subsequent takeoffs. The importance of the composition of financial flows is drawing increasing attention among economic researchers and has been recently examined by Caballero (2010) and Joyce (2010) in the context of banking crises, by Aizenman, Lee, and Sushko (2010) in the context exchange market pressure, and Aizenman and Sushko (2011) in the study of growth of externally financially dependent sectors.

We apply probit estimation methodology to assess the relationship between economic takeoffs during 1950-2000 and inflows of portfolio debt, portfolio equity, and FDI. In addition, we control for a country's stock of short-term external debt and commodity terms of trade, via a new improved measure. We find rich and complex marginal association between capital flows and economic takeoffs. Average level of FDI inflows is associated with a 23 percent higher takeoff probability relative to zero FDI inflow benchmark, and this effect is highest for the Latin America subsample, with a 65.4 rise in takeoff probability. Higher stock of short term external debt has been associated with a substantial ***negative*** effect on the probability of a takeoff, and the cumulative effect of the short terms debt overhang is largest for

[1] In our sample, the volatility of commodity terms of trade changes (as measured by the conditional standard deviation) is 18 percent for Latin American and 17 percent for Asian economies compared to 5 percent for OECD countries.

Latin American countries. Yet, virtually all the takeoffs were associated with a rise in portfolio debt inflows. This effect is substantial for Latin America, while it is virtually absent in Sub-Saharan Africa countries. An increase in annual portfolio debt inflow from 0 to 0.26 percent of GDP (mean value for the entire sample) is associated with a 25 percent higher probability of a takeoff. The association between financial links through portfolio equity flows and takeoffs is negative: a one standard deviation increase in equity outflows (inflows) is associated with a 47% (17%) decline in the probability of a takeoff. We also validate the key importance of commodity terms of trade shocks: a one standard deviation improvement in commodity terms of trade is associated with 28% higher takeoff probability.

The analysis of the duration of takeoffs shows that higher net portfolio debt inflows increase duration while the opposite is true of equity inflows. Also, greater improvement in a country's commodity terms of trade at the time of a takeoff is also associated with a higher probability that a takeoff will be sustained. In contrast, higher net FDI inflows at the time of the takeoff are associated with lower probability that the takeoff will be sustained. This finding parallels that of Prasad, Rajan, and Subramanian (2007), who find that the positive association between FDI and economic growth observed between 1970 and 2000 was no longer there for 2000 through 2004, and of Aizenman and Sushko (2011), who find that the relationship between FDI inflows and real sector growth turns from positive to negative following prolonged periods of steady FDI inflows into a country. One possible interpretation of this result is that countries in which economic takeoff is driven by FDI inflows converge to a new steady state faster, hence resulting on shorter duration of high growth rate. Alternatively, "green" FDI may compete for financing with domestic firms crowding out incumbent firms out of the local bank lending in emerging markets, especially if domestic financial industry is not sufficiently developed.

Evaluating the economic impact of financial capital inflows on duration, we obtain that for countries that have entered a takeoff phase average portfolio debt inflow increases the probability that a takeoff will last 8 years or more by approximately 16.9 percent. Similarly, average net portfolio equity inflow of 0.08 percent of GDP leads to 12.7 percent lower probability of a sustained takeoff while the average net FDI inflow of 1.07 percent of GDP at the time of the takeoff leads to 38.5 percent lower probability of a sustained takeoff.

2 Data

2.1 Takeoff definition

We employ the methodology of Aizenman and Spiegel (2010) to identify takeoff episodes. A takeoff is defined as the beginning of a five year consecutive growth of more than 5 percent following a stagnation episode. A stagnation episode is defined as at least a 5 year interval where the real per capita

GDP growth is below 1 percent.[2] The data consists of an unbalanced panel of 146 countries from 1950 through 2000. Of these, 114 countries have undergone stagnation episodes between 1960 and 1995 that could have resulted in a takeoff. Given the takeoff definition employed [see Aizenman and Spiegel (2010) and the background literature reviewed there], a country can experience more than one potential takeoff episode and indeed a number of countries underwent more than one takeoff episode during the sample period. Out of the total 241 stagnation episodes during our sample period, 131 have resulted in takeoffs (*TO=1*).

2.2 Financial conditioning variables

The aim of this section is to assess the relative contribution of different types of financial flows to the probability of a takeoff. Variable definition and sources are summarized in Table A1. We obtain data on portfolio debt flows, portfolio equity flows, and FDI flows from the IMF International Financial Statistics (*IFS*) database. We also control for a country's stock of short-term external debt using data from the Joint External Debt Hub (JEDH) database, joint IMF and the World Bank, which is available for countries that subscribe to the IMF's Special Data Dissemination Standard (SDDS). In order for the results not to be affected by short-run business cycle fluctuations, in the regression analysis all financial flow and stock variables enter as 5-year averages (% GDP). In addition, we introduce an improved commodity terms of trade (*CTOT*) measure following Ricci et. al (2008). Commodity prices in six categories (food, fuels, agricultural raw materials, metals, gold, and beverages) are weighted by the shares of each commodity in the country's exports and imports then deflated by the manufacturing unit value index (*MUV*). Since commodity import and export shares are averaged over time, in addition to being more accurate the movements in *CTOT* are invariant to changes in export and import volumes in response to price fluctuations and thus isolate the impact of commodity prices on a county's terms of trade (Spatafora and Tytell (2009)).

Table A2 lists starting observation by country for the data on financial flows and the stock of short-term external debt. The first column indicates the year(s) in which a country experienced an economic takeoff. If observations on financial controls end prior to the year 2000, the ending year is indicated in parentheses. Comparing the dates of economic takeoffs with first available dates on financial flow variables, Table A2 shows that for a number of countries we are constrained by the data availability from IFS and JEDH. For instance, the takeoff in Ghana occurred in 1960 whereas the disaggregated data on financial flows and short-term external debt does not become available until 1985. Similarly, Algeria underwent an economic takeoff in 1971 whereas the financial flow data does not become available for this nation until 1975. Thus, the analysis is constrained by data availability for a large subsample of

[2] See Aizenman and Spiegel (2010) for the detailed takeoffs definition employed in this paper.

countries that underwent a takeoff in the 1960s and 70s. However, to the extent that some of the same nations had undergone either a period of stagnation with a potential takeoff or a realized second takeoff episode later in the sample period they still feature in our estimation results.

Table 1 reports conditional and unconditional means and standard deviations of 5-year averages of financial flows (% GDP), 5-year average stock of short-term external debt (% GDP), and annual percent change in commodity terms of trade. The conditional summary statistics are calculated for the subsample defined by countries undergoing a stagnation episode with a potential for a takeoff (*TO=0*) or entering an economic takeoff (*TO=1*), while the unconditional statistics are based on the entire sample, irrespective of a country's state of economic growth. The first two columns of Table 1 report conditional and unconditional mean and standard deviations of capital flows for all countries, while subsequent columns report the same statistics for Latin America, Sub-Saharan Africa, Asia, and OECD countries separately.

Focusing on the means reported in the first two columns of Table 1, among capital flows, FDI inflows are the most important category with unconditional average annual inflow of approximately 2 percent of GDP compared to 0.4 percent for portfolio debt and 0.2 percent for portfolio equity inflows respectively. Both conditional and unconditional shares of FDI inflows are highest in Latin American economies with 3.4 and 3.3 percent of GDP respectively (columns 3 and 4). In addition, average annual portfolio equity inflows and FDI inflows are greater than outflows. In particular, FDI inflows from abroad are an order of magnitude greater than comparable repatriations by domestic citizens (1.22 compared to 0.18 percent of GDP), and this relationship is most pronounced for Latin American subsample with average annual FDI inflows of 3.44 percent of GDP, two orders of magnitude greater than comparable repatriations which comprise only 0.02 percent of GDP. As expected, the relationship between FDI inflows and outflow is more even for OECD countries (0.84 compared and 0.68 percent of GDP respectively), indicating that foreign direct investment flows tend to originate from developed countries dominating other types of financial inflows into developing countries during potential and realized economic takeoff episodes.

Portfolio debt flows play the second most important role among capital flows. Similar to FDI flows, the countries in our sample experience a net inflow of portfolio debt investment, 0.26 percent of GDP in annual inflows compared 0.13 percent in outflows. The relationship is even starker for Asian economies in a potential or a realized takeoff phase, with conditional average inflows more than 15 times greater than outflows, while it is reverse for Latin American subsample, with annual portfolio debt outflows approximately two times greater than inflows.

On the other hand, portfolio equity is the least important category of capital flows across all the subsamples. Similarly to FDI outflows, portfolio equity outflows are negative on average, indicating that

domestic citizens are redeeming their overseas equity and direct investments when a country is on the brink or entering a takeoff phase.

The conditional average stock of short-term external debt is approximately 5.68 percent of GDP for the entire sample, with Asian and Sub-Saharan Africa countries holding slightly lower shares than the mean at 4.49 and 4.72 percent of GDP respectively, while Latin American countries on average hold two times greater share of short-term external debt to GDP at 9.12 percent. Finally, counties in stagnation or on the brink of a takeoff tend to be experiencing a mild deterioration in the terms of trade at -1.18 percentage points. However, the standard errors for this series are an order of magnitude higher than the mean for all subsamples except for OECD countries, pointing at a considerable cross-country and time variation in the terms of trade changes even when smoothed to 5-year tolling averages.

2.3 Additional controls

The remaining controls follow Aizenman and Spiegel (2010) and proxy for a country's institutional features, industrial and financial development, political stability, and economic openness. We measure *de facto openness* as the ratio of exports plus imports over GDP in local currency units using *IFS* data. The average annual *tariff rate* for each country was obtained from Dollar-Kraay (2004) data. We measure *income level* of log of GDP per capita and *population* as log of total population using Heston, Summers, and Aten (2009) Penn World Tables 6.3. We combine these variables with regional dummies for *Latin America*, *Sub-Saharan Africa*, *Asia*, and *OECD* for our base specification.

The baseline specification is then augmented with additional conditioning variables. We measure *years of schooling* as the average years of education in the population above the age of 25 from the Barro and Lee (1993) dataset. The data on commodities, manufacturing, and services as share of GDP come from the *WDI* data labeled *Comm/GDP*, *Manuf/GDP*, and *Serv/GDP* respectively. Also from WDI we obtain measure of domestic credit, liquid liabilities, and money to GDP ratios labeled *DomCredit*, *Liquidity*, and *Money* respectively. Following Hausmann, Pritchett, and Rodrik (2005), we construct a political regime change indicator, *Reg.Chng*., as a three-unit change in the Marshall-Jaggers (2002) *Policy IV* dataset. The variable *War End* takes on a value of 1 if there has been a cessation of conflict within the previous 5 years and 0 otherwise and the variable Civil War takes on a value of 1 if there has been a civil war within the previous 5 years and zero otherwise. Both variables come from the Singer and Small (2003) *Correlates of War* database. Finally, the *Leader Death* political variable comes from the Jones and Olken (2005) dataset and takes on the value of 1 if a country's leader has died within the previous 5 years and 0 otherwise.

3 Non-Parametric Analysis

Table 2 shows the differences in the means of financial flows for subsamples of countries that do not experience a takeoff with 10 years following a stagnation episode (*TO=0*) and those that do (*TO=1*). Countries that experience a takeoff have somewhat lower level of portfolio debt and FDI outflows on the on hand and statistically significantly greater level of portfolio debt and FDI inflows on the other. Most notably, the average FDI inflows are approximately 1.8% higher for countries that experience a takeoff compared to those that do not. The results are opposite for portfolio equity flows: countries that undergo a takeoff episode have statistically significantly larger equity outflows and marginally lower equity inflows. The negative association between portfolio equity outflows and successful transition from economic stagnation to a takeoff may be due to the flight of domestic savings to foreign equities, especially in Latin American countries. We address this association in the parametric estimation results. Finally, countries that undergo a takeoff following a stagnation phase have on average lower stock of short-term external debt (% GDP) and an increase in commodity terms of trade (CTOT), but these differences are statistically insignificant in this preliminary non-parametric examination.

Figures 1 through 3 illustrate the time-series relationship between selected takeoff conditioning variables and economic growth for three countries from each of the following regions: Caribbean-Latin America, East and South Asia, and Sub-Saharan Africa. The year(s) in which a country experienced an economic takeoff are marked with vertical bars. As Figure 1 shows, the growth rate of real GDP exhibits a negative association with a country's stock of short-term external debt. Taking Philippines as an example, the rise in short-term external debt from less than 10 percent to 30 percent of GDP between 1975 and 1982 was followed by a sharp contraction in annual GDP growth rate from close to 5 to -10 percent per year over the same time period. This period of economic stagnation was finally followed by a takeoff in 1992, which was preceded by a reduction in short-term external debt to its pre-1975 level of approximately 10 percent of GDP.

Figure 2 focuses on the association between economic growth and FDI inflows. Consistent with the subsample analysis of the means in Table 1, the graphical examination points at the positive co-movement in the two series. Focusing on the experience of Fiji and Mexico, the 1983 and 1995 respective takeoffs in the two countries were preceded by a rise in annual FDI inflows (from approximately 0 to 2 percent of GDP in Fiji and from 1 to 3 percent of GDP in Mexico).

Finally, Figure 3 examines the time-series behavior of GDP growth rates and change in a country's commodity terms of trade (CTOT). As in the case with FDI inflows, the series exhibit positive co-movement for the majority of the selected countries. Focusing on Latin American countries, economic growth and CTOT of Argentina, Chile, and Mexico exhibit a close relationship. Both the 1973 and 1983

takeoff episodes in Chile were preceded by a change in CTOT movement from deterioration (less than 0) to an improvement (greater than 0) in the years prior.

4 Parametric Analysis

4.1 Methodology

Following Aizenman and Spiegel (2010) we use a probit estimation methodology. Specifically for a country *i* we estimate the conditional probability of *TO=1* given our set of financial flow and stock variables and a number of country level controls:

$$\Pr(TO_i = 1|\boldsymbol{x}_i, \boldsymbol{y}_i, \boldsymbol{z}_i, \boldsymbol{\beta}, \boldsymbol{\gamma_1}, \boldsymbol{\gamma_2}) = 1 - \Phi(\boldsymbol{x}_i{}'\boldsymbol{\beta} + \boldsymbol{y}_i{}'\boldsymbol{\gamma_1} + \boldsymbol{z}_i{}'\boldsymbol{\gamma_2}), \quad (1)$$

where Φ( ) denotes the cumulative distribution function of a standard normal variable and the vectors of controls include:

$$\boldsymbol{x}_i = \begin{bmatrix} \text{port. debt outflows} \\ \text{port. debt inflows} \\ \text{port. equity outflows} \\ \text{port. equity inflows} \\ \text{FDI outflows} \\ \text{FDI inflows} \end{bmatrix}, \boldsymbol{y}_i = \begin{bmatrix} \text{short term external debt} \\ \text{change in CTOT} \\ \text{openness} \\ \text{tariff rate} \\ \text{income level} \\ \text{population} \\ \text{regional dummies} \end{bmatrix}, \boldsymbol{z}_i = \begin{bmatrix} \text{Years of schooling} \\ \text{Comm/GDP} \\ \text{Manuf/GDP} \\ \text{Serv/GDP} \\ \text{DomCredit} \\ \text{Liquidity} \\ \text{Money} \\ \text{Reg. Chng.} \\ \text{Civil War} \\ \text{War End} \\ \text{Leader Death} \end{bmatrix}.$$

We are most interested in the coefficient vector on $\boldsymbol{x_i}$, as well as coefficients on short-term external debt and change in CTOT. The remaining controls have been examined by AS2010 and are included for robustness. The estimation is conducted with robust standard errors clustered by country, as several countries in the sample undergo more than one takeoff episode. Having obtained the coefficient vector, we can evaluate the marginal effect of each control variable on the conditional expectation of a takeoff:

$$\frac{\partial E(TO_i|\boldsymbol{x}_i, \boldsymbol{y}_i, \boldsymbol{z}_i, \hat{\boldsymbol{\beta}}, \hat{\boldsymbol{\gamma}}_1, \hat{\boldsymbol{\gamma}}_2)}{\partial x_i} = f(-(\overline{\boldsymbol{x}}_i{}'\hat{\boldsymbol{\beta}} + \overline{\boldsymbol{y}}_i{}'\hat{\boldsymbol{\gamma}}_1 + \overline{\boldsymbol{z}}_i{}'\hat{\boldsymbol{\gamma}}_2))\hat{\beta}. \quad (2)$$

Probit regressions allow to evaluate the marginal contribution of each conditioning variable to the probability of *TO=1*, with partial effect in (2) estimated at the sample average of all controls variables.

We then evaluate the economic impact of each control on the probability of a takeoff in three ways. *The first method consists of multiplying the estimate of the partial effect in (2) by the variable's mean*, which gives us an estimate of the probability change relative to the benchmark of zero for the control of interest. For example, by multiplying the mean annual FDI inflows by their partial contribution to the probability of a takeoff in (2) we obtain an estimate of the change in the likelihood of a takeoff relative to the case if the country was experiencing zero FDI inflows. *The second method consists of multiplying the value in equation (2) by the variable's standard deviation* to evaluate its economic impact on the probability of a takeoff. Both first and second method assume that the marginal contribution of each explanatory variable to the probability of *TO=1* is constant across the entire support, which is the same as assuming a linear cumulative probability density, a highly unrealistic assumption. Therefore, *the third method consists of measuring the differences in the predicted probabilities of a takeoff between specific countries whose values of conditional variables are approximately one standard deviation apart*, with the lower value drawn close to the sample mean.

4.2 Estimation Results

The probit regression results for baseline specification used in the standard deviation analysis above are reported in Table 3. Specifications (1) through (6) report probit estimates for all countries, with specifications (4) through (6) including the stock of short-term external debt (% GDP) in the control vector. Specifications (7) and (8) exclude countries classified as "High Income" in the WDI data focusing only on "Low & Middle Income" countries. Instead of reporting the probit coefficient vector that does not have a ready economic interpretation, we report marginal effects of each independent variable and the associated standard errors. The interpretation follows equation (2) and quantifies the probability change of observing a takeoff due to a unit change in the conditioning variable. For example, focusing on specification (2) used in the one standard deviation analysis in previous sections, the coefficient of -0.54 on Latin American dummy indicates that evaluated at sample means of the entire control vector, the probability of *TO=1* is 54 percent lower for Latin American economies.

As a way to check the goodness of fit of the mode, Figure 3 plots probit regression residuals and well as actual versus fitted values based on regression specification (2) in Table 6. As the figure shows, the residuals are fairly well behaved and centered around zero. The model fits the majority of takeoff episodes fairly well, with substantial errors resulting when the model predicted a takeoff where one was not realized in 1982 in Australia and in 1983 in Comoros.

As results reported in Table 3 indicate, most associations between takeoff probability and financial capital flows are robust to alternative specifications. The marginal effect of portfolio debt inflows on takeoff probability is positive and statistically significant in 7 out of 8 specifications. The marginal effects of both equity inflows and outflows are negative (with the exception of outflows in specifications (4) and (6)), while the marginal effects of links through FDI flows are positive and statistically significant in a number of specifications.

Since economic takeoffs are primarily a feature of emerging and developing economies, specifications (7) and (8) only include low and middle income countries in the sample. The effect of portfolio debt outflow is negative but becomes statistically significant (-0.899*** compared to -0.043) while the positive effect of portfolio debt inflows more than doubles in magnitude (2.026*** compared to 0.905***) in specification (7) compared to specification (1). The coefficients on portfolio equity flows remain negative, with the effect of a 1 percentage point increase in portfolio equity outflows taking on the value of -3.854* compared to -3.316** and the negative marginal effect of portfolio equity inflows becoming significantly larger and statistically significant (-3.715*** compared to -0.901) in specification (7) compared to specification (1). Focusing on the third capital flow category, the marginal effect of FDI outflows is insignificant when high income countries are excluded from the sample, while the coefficient on remains positive and significant with approximately the same magnitude. The marginal effect of commodity terms of trade improvement is also positive and statistically significant. Overall, the specifications (7) and (8) indicate that the marginal effects of most capital flows on the probability of economic takeoff are more pronounced when only low and middle income countries are considered. The marginal effect of portfolio debt, FDI inflows, and commodity terms of trade are positive, with the effect of debt more than double for this subsample of countries, while the negative effects of portfolio debt outflows and portfolio equity flows in both directions are larger in magnitude.

Focusing on the stock of "hot money," as specifications (3) through (6) indicate the marginal effect of stock of short-term external debt is negative, confirming the popular prior that unlike direct investment, "hot money" is detrimental to economic takeoffs. Notably, the data on short-term external debt is available for a smaller sample, reducing the number of observations from above 90 in specifications (1) through (3) to 65 or less in specification (5) through (6), which can result in the instability of coefficients on several controls variables.

Table 4 shows probit estimation results of the association between financial flows and takeoffs with expanded set of controls following (note that controls from the baseline specification also included in the regression but results not reported for brevity). The results indicate that the positive association between the probability of a takeoff and foreign debt investment flows as well as between the two-way FDI flows and takeoffs is robust to controlling for a set of political, industrial, financial, and demographic

country characteristics. Unlike linkages through FDI flows, linkages through equity markets exhibit a negative association with the probability of a takeoff, with coefficients on portfolio investment equity asset flows particularly robust. In addition, portfolio debt outflows also exhibit negative association with the probability of a takeoff. However, the significance of the coefficients is not very robust to alternative specifications. The association between takeoffs and short-term external debt is statistically significant and robust given this larger set of controls. Overall, the results of Table 4 are consistent with baseline regressions indicating that takeoff episodes are positively associated with inflows of foreign debt investments and two-way FDI linkages and negatively associated with financial capital flows abroad and the buildup of short-term external debt.

Table 5 reports baseline regression results interacting financial flow variables with selected regional dummies. A conjecture being examined is that the negative association between equity flows abroad is a feature of Latin American countries where foreign equities traditionally serve as a store of value of a large segment of wealth population. The coefficient on the interaction term between portfolio equity assets and Latin America dummy is negative, statistically significant, and an order of magnitude larger indicating that this feature is characteristic of Latin American economies.

4.3 Economic Impact

Table 6 and Table 7 report the estimated economic impact of the conditioning variables on the probability of a takeoff. Table 6 shows the estimates obtained by multiplying subsample mean value of each variable by its marginal effect in equation (2) giving the change in the probability of $TO=1$ due to the deviation in the explanatory variable from zero by its subsample mean. For example, an increase in annual portfolio debt inflow from 0 to 0.26 percent of GDP (mean value for the entire sample (Table 1)) is associated with a 24.6 percent higher probability of a takeoff. Average level of FDI inflows is associated with a 23.2 percent higher takeoff probability relative to zero FDI inflow benchmark and this effect is highest for the Latin America subsample with a 65.4 rise in takeoff probability. Higher stock of short-term external debt has a substantial negative effect on the probability of a takeoff. Given the sample mean short-term debt holdings of 5.7 percent of GDP (see Table 1), the probability of an economic takeoff is 25.6 percent lower relative to the zero short-term debt benchmark. The cumulative effect is largest for Latin American countries, where, given their average short-term debt holdings, the probability of a takeoff is reduced by 41.0 percent relative to the zero debt benchmark.

The results in Table 7 are based on standard deviations for the entire sample and the subsamples of Latin American, Sub-Saharan Africa, and Asian countries. Focusing on the variables with statistically significant coefficients (denoted by asterisks), a one standard deviation increase in the inflow of portfolio debt is associated with 71.1 percent higher probability of a takeoff. The effect is even larger for Asia

(93.7 percent) suggesting that virtually all the takeoffs in these countries during our sample period were associated with a rise in portfolio debt inflows. At 41.5 percent, the effect is also substantial for Latin America, while it is virtually absent in Sub-Saharan Africa countries (0.1 percent).

In contrast to portfolio debt inflows, the association between portfolio equity flows and takeoffs is negative. In particular, a one standard deviation increase in equity outflows is associated with a 47.0 percent decline in the probability of a takeoff. The effect is much smaller for geographical subsamples, indicating that given this methodology it is driven by large standard deviation in portfolio equity outflows of OECD countries (the standard deviation of these flows is 0.23 percent of GDP in OECD compared to 0.02 in Latin American countries).

Unlike portfolio equity flows, greater linkages through FDI flows exhibit positive association with the probability of a successful transition from economic stagnation to a takeoff. A one standard deviation increase in FDI outflows is associated with a 62.3 percent higher probability of an economic takeoff. As is the case with the one standard deviation analysis for equity outflows, this high figure for the combined sample is driven by high standard deviation of FDI outflows from OECD countries. The next row in Table 7 shows that a one standard deviation rise in FDI inflows is associated with 75.5 percent greater chance of an economic takeoff. The impact is 84.7 percentage points for Latin American countries while it is lower for Sub-Saharan Africa and Asian countries at 18.7 and 29.3 percentage points respectively.

The positive association between FDI flows and takeoff probability can be substantially offset if a country accumulates the stock a short-term external debt. A one standard deviation rise short-term external debt as a percentage of GDP is associated with 37.5 lower takeoff probability. The impact is more severe in Latin American countries at -55.7 percentage points, while slightly below the full sample average in absolute value for African and Asian economies.

Finally, a one standard deviation improvement in commodity terms of trade is associated with a 28.4 percent higher takeoff probability. At 31.0 percent, the association is marginally higher for Latin American countries, most likely due to greater proportion of commodity exporters in this region.

As mentioned above, the marginal contribution of control variables to the probability of a takeoff is estimated at a point on the cumulative density corresponding to the sample means of controls. Since the relationship between the takeoff probability and the values of the conditioning variables is not necessarily linear, the first derivative of the density function that captures the marginal effect of an incremental increase in control to the probability of $TO=1$ is also subject to change. The sensitivity of the estimates presented in Table 6 and Table 7 to the value of controls is captured in Figure 5 and Figure 6. The figures show predicted probability of a takeoff as a function of portfolio debt inflows and portfolio equity outflows respectively (both significant determinants of takeoff in the probit regressions). The fitted line

represents the best fractional polynomial fit to the predicted probabilities. Since the predicted probability density is best fitted by a concave curve, the marginal effects are not constant along the support of each control variable. To address this issue, we pick actual observations for each control variable that are approximately one standard deviation apart and report the associated change in the predicted value for the probability of *TO=1*. Table 8 reports the results.

Focusing on the variables with significant coefficients in the probit regressions, Table 8 shows that a rise in 5-year average portfolio debt inflow from 0.25 (South Africa in 1991) to 1.03 percent of GDP (Thailand in 1998) is associated with a rise in predicted probability of a takeoff of 39.3 percent. A rise in portfolio equity outflow from -0.03 (repatriation in Korea in 1994) to 0.11 percent of GDP (Israel in 1989) is associated with a fall in predicted takeoff probability of 60.5 percent. Also, as the previous estimates indicated, FDI flows are positively associated with predicted takeoff probabilities. In particular, a rise in FDI inflows from 1.24 (Mexico in 1980) to 5.71 percent of GDP (Malaysia in 1992) is associated with a 74.0 percentage point rise in the predicted takeoff probability. On the other hand, a rise in the 5-year average of the stock of short-term external debt from 5.5 (Mexico in 1980) to 14.6 percent of GDP (Bolivia in 1986) is associated a 20 percentage point decline in the predicted probability of a takeoff. The negative relationship between stock of short-term external debt and takeoff probability is shown in Figure 7. For a given increase in the stock of short-term external debt, the decline in the predicted probability of a takeoff appears rapid and monotone, with correlation coefficient of -0.2081 (p-value = 0.000). Unlike the association between financial flows, which was highly non-linear, the negative relationship between short-term external debt and takeoff probability is fairly well approximated by a linear fit, which is consistent with similar magnitude of economic impact for this variable reported in Tables 6 and 7. Overall, in terms of the relative magnitudes of the predicted impact on the probability of a takeoff, the results reported in Table 8 are broadly consistent with estimates under more restrictive assumptions reported in Table 7.

The heightened volatility of commodity prices renewed concerns about the greater exposure of developing countries to commodity terms of trade shocks, as a given change in the relative prices of commodities tends to induce a much larger income effect in poorer countries. Figure 8 shows that the association percent change in commodity terms of trade (*dCTOT*) and the probability of a takeoff (*TO=1*) is highly dependent on country income. More precisely, the figure depicts the income effect of commodity terms of trade shock for countries of different income levels.

The income effect is proxied by the marginal effect of a positive commodity terms of trade shock on the on the probability of a takeoff. The left axis shows marginal effects estimated with baseline probit specification (2) at the given income level (horizontal axis, log scale); z-statistics of estimated coefficients in parentheses. Points of GDP per capita corresponding to subsamples averages of Sub-Saharan Africa,

Latin America, Asia, and OECD are labeled accordingly. Marginal effect of approximately 1.7 for a country with GDP per capita of $4,000 (which is the subsample average for Asian countries) indicates that a 1 percent improvement in the commodity terms of trade is associated with a 1.6 percent higher predicted probability of economic takeoff. Note that both the magnitude and statistical significance of marginal effects of *dCTOT* on Pr(*TO=1*) are highest for developing Latin American and Asian economies in the middle income range, then drops off dramatically with income.

The right axis follows the one-standard deviation analysis procedure showing the product of the marginal effect coefficient in baseline specification (2) multiplied by the subsample standard deviation of *dCTOT* for each income range. For a country with income level of approximately $4,000 per capita a one standard deviation improvement in commodity terms of trade is associated with greater than 25 percent higher probability of a takeoff. Thus, a one standard deviation improvement in the terms of trade in Latin American and Asian economics translates into a 25 percentage and 28 percentage points higher takeoff probability compared to a much lower 6 percentage point improvement for OECD economies. Overall, the marginal effects from the baseline probit regression estimated at different income levels confirm the notion that developing economies are much more sensitive to commodity terms of trade shocks, with estimates for these countries larger in both magnitude and in statistical significance.

5. Determinants of sustained takeoffs

This section examines the relationship between duration of takeoffs and the nature of financial exposure at the time of the takeoff. Following Aizenman and Spiegel (2010), we define sustained takeoffs as periods of high growth lasting at least 8 years. Given such second stage of conditioning, the sample is significantly reduced. To compensate, we reduce the control vector by looking at net flows in each financial capital category. Table 9 presents the marginal effects from probit estimation results.

Consistent with their association with an occurrence of a takeoff, higher net portfolio debt inflows raise the probability of a sustained takeoff while net portfolio equity inflows lower the probability of a sustained takeoff. Also consistent with the its association with an initial takeoff, greater improvement in a country's commodity terms of trade at the time of a takeoff is associated with a higher probability that a takeoff will be sustained.

However, the association between net inflows of FDI at the time of the takeoff has the opposite impact on its duration. While the preceding analysis shows that higher FDI inflows are associated with higher probability of an economic takeoff, the negative and statistically significant marginal effect reported in Table 9 indicates that higher net FDI inflows at the time of the takeoff are associated with lower probability that the takeoff will be sustained. This finding parallels that of Prasad, Rajan, and Subramanian (2007), who find that the positive association between FDI and economic growth observed

between 1970 and 2000 was no longer there for 2000 through 2004, and of Aizenman and Sushko (2011), who find that the relationship between FDI inflows and real sector growth turns from positive to negative following prolonged periods of steady FDI inflows into a country. One possible interpretation of this result is that countries in which economic takeoff is driven by FDI inflows converge to a new steady state faster, hence resulting on shorter duration of high growth rate. Alternatively, "green" FDI may compete for financing with domestic firms crowding out incumbent firms out of the local bank lending in emerging markets, especially if domestic financial industry is not sufficiently developed.

Next, we assess the economic impact of the three types of capital flows relative to the zero benchmark using their averages conditional on country being in a takeoff phase. Multiplying the 0.47 percent of GDP average net portfolio debt inflow by the 0.36 marginal effect reported in specification (1) of Table 9, we obtain that for countries that have entered a takeoff phase average portfolio debt inflow increases the probability that a takeoff will last 8 years or more by approximately 16.9 percent. Similarly, average net portfolio equity inflow of 0.08 percent of GDP leads to 12.7 percent lower probability of a sustained takeoff while the average net FDI inflow of 1.07 percent of GDP at the time of the takeoff leads to 38.5 percent lower probability of a sustained takeoff.

Moving to the interpretation of additional controls, country income exhibits a negative association with takeoff duration, indicating that the probability of a sustained high rate of economic growth is lower for economies with higher GDP per capita at the time of the takeoff. The marginal effects of population and openness are positive, indicating that more populous open economies tend to experience longer lasting periods of high growth following entry into a takeoff phase. Focusing on regional dummies, in most specifications Latin American, Asian, and Sub-Saharan African countries tend to experience shorter takeoff, which the negative marginal effect of the Sub-Saharan dummy particularly robust. Finally, a positive marginal effect of regime change dummy indicates that the likelihood of a sustained takeoff is higher if it was preceded by a political regime change.

The last specification in Table 9 includes the stock of short-term external debt as a control. The marginal effect is negative, however not statistically significant at the 10 percent level. In addition, combined with greater censoring of the dependent variable and data availability on the "hot money" variable, the sample is greatly reduced, making inference based on this specification somewhat problematic.

6. Conclusion

We apply probit estimation methodology to assess the relationship between economic takeoffs during 1950-2000 and inflows of portfolio debt, portfolio equity, and FDI. In addition, we control for a country's stock of short-term external debt and commodity terms of trade, via a new improved measure.

We find rich and complex marginal association between capital flows and economic takeoffs. Regionally, Latin American economies exhibit the greatest sensitivity to financial linkages. The association between financial links through portfolio equity flows and takeoffs is negative. So is the association with stock of short term external debt, with the cumulative effect of the short terms debt overhang largest for Latin American. Yet, virtually all the takeoffs were associated with a rise in portfolio debt inflows. This effect is also substantial for Latin America, while it is virtually absent in Sub-Saharan Africa countries. Average level of FDI inflows is associated with a higher takeoff probability and this effect is highest for the Latin America subsample. We also validate the key importance of commodity terms of trade shocks: a one standard deviation improvement in commodity terms of trade is associated with 28% higher takeoff probability.

The analysis of the duration of takeoffs shows that higher net portfolio debt inflows increase duration while the opposite is true of equity inflows. Also, greater improvement in a country's commodity terms of trade at the time of a takeoff is associated with a higher probability that a takeoff will be sustained. In contrast, higher net FDI inflows at the time of the takeoff are associated with lower probability that the takeoff will be sustained. Comparing the economic magnitudes of the association with each type of private capital inflow, FDI exhibits the largest (and negative) effect, potentially offsetting the positive effect of portfolio debt inflows in sustaining the takeoff episodes. In sum, not just the degree of financial openness, but the nature of financial integration matters greatly for a country's prospect of entering and sustaining economic takeoffs. Furthermore, the complex association between FDI and economic takeoffs – direct financing is associated with greater number of takeoffs, but not with the most sustained ones – is in line with several recent studies that detect complex and non-linear association between the accumulation of FDI and growth.

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Tables

Table 1: Means and standard deviations of the financial determinants of economic takeoffs

	All		Latin America		Sub-Saharan Africa		Asia		OECD	
	Cond.	Uncond.	Cond.	Uncond.	Cond.	Uncond.	Cond.	Uncond.	Cond.	Uncond.
portfolio debt outflow (% GDP)	-0.130	-0.247	-0.226	-0.093	-0.005	-0.023	-0.022	-0.006	-0.352	-0.796
	(0.781)	(1.126)	(0.923)	(0.699)	(0.024)	(0.127)	(0.048)	(0.236)	(1.379)	(1.956)
portfolio debt inflow	0.262	0.399	0.148	0.298	0.001	0.022	0.356	0.168	0.795	1.121
	(0.757)	(0.982)	(0.442)	(1.088)	(0.011)	(0.192)	(0.998)	(0.596)	(1.217)	(1.326)
portfolio equity outflow	-0.031	-0.145	-0.002	-0.020	-0.001	-0.012	0.000	-0.004	-0.091	-0.382
	(0.133)	(0.825)	(0.017)	(0.122)	(0.028)	(0.181)	(0.000)	(0.037)	(0.232)	(1.199)
portfolio equity inflow	0.075	0.191	0.083	0.078	0.054	0.053	-0.001	0.089	0.151	0.461
	(0.261)	(1.070)	(0.347)	(0.273)	(0.208)	(0.279)	(0.002)	(0.288)	(0.352)	(1.755)
fdi outflow	-0.180	-0.373	-0.019	-0.075	-0.038	-0.135	0.002	-0.099	-0.681	-1.000
	(0.520)	(1.039)	(0.046)	(0.239)	(0.108)	(0.472)	(0.016)	(0.251)	(0.863)	(1.440)
fdi inflow	1.218	1.999	3.443	3.275	0.486	1.099	1.392	1.571	0.843	1.315
	(3.972)	(5.130)	(8.918)	(4.638)	(0.984)	(2.840)	(1.540)	(1.869)	(0.868)	(1.500)
short-term external debt	5.683	6.651	9.115	8.446	4.721	6.285	4.495	4.978	0.000	0.000
	(8.332)	(10.419)	(12.369)	(15.501)	(6.362)	(8.116)	(7.706)	(5.736)	(0.000)	(0.000)
change in CTOT (% Chng.)	-1.180	-1.024	-4.395	-2.146	1.150	-1.002	-7.131	-1.526	-2.471	-1.088
	(16.587)	(13.960)	(18.141)	(17.216)	(17.931)	(15.477)	(16.499)	(12.569)	(4.788)	(9.659)

Notes: The table reports conditional and unconditional means and standard deviations of 5-year averages of financial flows, 5-year average stock of short-term external debt, and annual percent change in commodity terms of trade. The conditional summary statistics are calculated for the subsample defined by countries undergoing a stagnation episode with a potential for a takeoff (*TO=0*) or entering an economic takeoff (*TO=1*).

Table 2: Financial flows, short-term external debt, and terms of trade: non-takeoffs vs. takeoffs

Conditioning variables	*TO* = 0	*TO* = 1	*Diff.*	
portfolio debt outflow	-0.0015	-0.0011	0.0004	
	(0.0014)	(0.0007)	(0.0016)	
		p-value	0.4071	
portfolio debt inflow	0.0006	0.0047	**0.0041**	***
	(0.0003)	(0.0014)	**(0.0014)**	
		p-value	0.0032	
portfolio equity outflow	-0.0001	-0.0005	**-0.0004**	**
	(0.0001)	(0.0002)	**(0.0003)**	
		p-value	0.0458	
portfolio equity inflow	0.0009	0.0006	-0.0003	
	(0.0004)	(0.0003)	(0.0005)	
		p-value	0.3079	
fdi outflow	-0.0020	-0.0016	0.0005	
	(0.0008)	(0.0006)	(0.0010)	
		p-value	0.3313	
fdi inflow	0.0062	0.0176	**0.0113**	*
	(0.0013)	(0.0073)	**(0.0074)**	
		p-value	0.0648	
short-term external debt	0.0589	0.0545	-0.0044	
	(0.0093)	(0.0147)	(0.0174)	
		p-value	0.4005	
change in CTOT	-0.0250	0.0004	0.0254	
	(0.0171)	(0.0154)	(0.0231)	
		p-value	0.1358	

Note: Means of conditioning variables for countries that do not (TO=1) and do (TO=1) experience a takeoff following a period of stagnation. *, **, and *** indicate the differences in means statistically significant at 10%, 5%, and 1% level respectively.

Table 3: Takeoffs and financial flows, base regressions (dependent variable: realization of a takeoff)

	All Income Levels					Low & Middle Income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
portfolio debt outflow	-0.043	-0.045	-0.013	**9.691*** **	**5.155***	-10.517	**-0.899*** **	**-0.977***
	(0.130)	(0.151)	(0.133)	**(3.334)**	**(2.743)**	(11.247)	**(0.340)**	**(0.399)**
portfolio debt inflow	**0.905*** **	**0.939***	**0.919***	**1.339***	**1.309***	1.927	**2.026*** **	**1.984***
	(0.326)	**(0.381)**	**(0.369)**	**(0.627)**	**(0.531)**	(1.519)	**(0.639)**	**(0.864)**
portfolio equity outflow	**-3.316***	**-3.544***	**-3.662***	0.598	-0.902	**23.678*** **	**-3.854***	**-4.114***
	(1.453)	**(1.508)**	**(1.590)**	(4.876)	(5.446)	**(7.040)**	**(2.155)**	**(2.332)**
portfolio equity inflow	-0.601	-0.645	-0.558	-0.241	-0.36	**-0.919***	**-3.715*** **	**-4.063*** **
	(0.385)	(0.423)	(0.348)	(0.414)	(0.348)	**(0.441)**	**(1.286)**	**(1.508)**
fdi outflow	**1.059***	**1.198***	**1.199***	**1.139***	0.587	12.06	1.260	1.389
	(0.482)	**(0.519)**	**(0.564)**	**(0.665)**	(1.035)	(11.074)	(0.778)	(0.851)
fdi inflow	**0.145***	**0.190***	0.094	**0.330*** **	**0.179***	0.271	**0.221***	**0.331***
	(0.063)	**(0.102)**	(0.072)	**(0.114)**	**(0.104)**	(0.351)	**(0.128)**	**(0.163)**
change in CTOT		**0.017*** **	**0.021*** **	**0.028*** **				**0.014***
		(0.005)	**(0.006)**	**(0.009)**				**(0.008)**
openness			-0.094		**-0.499***	-0.796		
			(0.253)		**(0.288)**	(0.699)		
short-term external debt				**-0.020***	-0.033	-0.045		
				(0.011)	(0.022)	(0.035)		
tariffavg10yr						**-0.017***		
						(0.010)		
loggdp	**-0.300***	-0.262	-0.202	-0.21	-0.11	-0.332	**-0.994*** **	**-0.953*** **
	(0.158)	(0.163)	(0.150)	(0.172)	(0.174)	(0.323)	**(0.348)**	**(0.356)**
logpop	-0.002	0.000	-0.026	-0.044	-0.106	-0.15	0.069	0.08
	(0.042)	(0.047)	(0.063)	(0.057)	(0.077)	(0.106)	(0.074)	(0.077)
Latin America	**-0.456*** **	**-0.539*** **	**-0.547*** **	**-0.637*** **	**-0.686*** **	**-0.584***	**-0.755*** **	**-0.682*** **
	(0.169)	**(0.121)**	**(0.129)**	**(0.110)**	**(0.154)**	**(0.265)**	**(0.162)**	**(0.189)**
Sub-Saharan Africa	**-0.673*** **	**-0.709*** **	**-0.669*** **	**-0.804*** **	**-0.749*** **	**-0.642***	**-1.000*** **	**-1.000*** **
	(0.209)	**(0.182)**	**(0.185)**	**(0.169)**	**(0.184)**	**(0.386)**	**(0.001)**	**(0.001)**
Asia	-0.2	-0.175	-0.112	0.178	-0.096	**0.694*** **		
	(0.271)	(0.306)	(0.311)	(0.361)	(0.307)	**(0.251)**		
OECD	0.283	0.265	0.218					
	(0.214)	(0.217)	(0.194)					
Observations	99	98	90	65	57	38	61	60
Pseudo R-squared	0.33	0.39	0.40	0.41	0.31	0.46	0.50	0.51

Notes: Probit estimation results with clustering by country and robust standard errors in parenthesis. *, **, and *** indicate coefficients significant at 10%, 5%, and 1% level respectively. Marginal effect estimates used in the standard deviation analysis take from specification (2) (highlighted). For specifications (3), (5), and (6) OECD dummy dropped due to collinearity. For specifications (7) and (8), Asia dummy predicts success perfectly, therefore dropped and 3 observations not used.

Table 4: Takeoffs and financial flows, extended control vector (dependent variable: realization of a takeoff)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
portfolio debt outflow	-0.045	-0.096	-0.191	**9.691*** **	**8.538** **	1.116	**4.947***	**-0.615** **	-0.039
	(0.151)	(0.192)	(0.260)	**(3.334)**	**(3.474)**	(2.849)	**(2.825)**	**(0.314)**	(0.151)
portfolio debt inflow	**0.939** **	**0.963*** **	**0.719*** **	**1.339** **	**1.122***	**0.664***	0.410	**1.399*** **	**0.974*** **
	(0.381)	**(0.256)**	**(0.246)**	**(0.627)**	**(0.614)**	**(0.402)**	(0.525)	**(0.460)**	**(0.352)**
portfolio equity outflow	**-3.544** **	**-4.334***	**-2.740*** **	0.598	1.109	-0.148	-1.251	-0.28	**-3.765** **
	(1.508)	**(2.289)**	**(1.005)**	(4.876)	(4.635)	(4.820)	(4.911)	(2.256)	**(1.548)**
portfolio equity inflow	-0.645	**-0.783***	-1.355	-0.241	-0.132	-0.567	-0.646	**-1.099** **	-0.632
	(0.423)	**(0.424)**	(1.012)	(0.414)	(0.434)	(0.389)	(0.778)	**(0.516)**	(0.449)
fdi outflow	**1.198** **	**1.317*** **	**0.829*** **	**1.139***	0.971	1.573	0.644	**1.518** **	**1.266** **
	(0.519)	**(0.501)**	**(0.286)**	**(0.665)**	(0.682)	(1.408)	(0.596)	**(0.655)**	**(0.532)**
fdi inflow	**0.190***	**0.228** **	**0.220** **	**0.330*** **	**0.354*** **	**0.419*** **	**0.205** **	**0.253*** **	**0.152** **
	(0.102)	**(0.108)**	**(0.101)**	**(0.114)**	**(0.117)**	**(0.160)**	**(0.103)**	**(0.076)**	**(0.064)**
change in CTOT	**0.017*** **			**0.029*** **	**0.026*** **				
	(0.005)			**(0.009)**	**(0.007)**				
short-term external debt				**-0.020***		**-0.045** **	**-0.029***		
				(0.011)		**(0.021)**	**(0.018)**		
years of schooling		0.046				**0.147***			
		(0.044)				**(0.075)**			
regchange									
Civil War			-0.325				**-0.311*** **		
			(0.208)				**(0.118)**		
War End			0.234				**0.566** **		
			(0.222)				**(0.247)**		
Lead Death			-0.153						
			(0.307)						
DomCredit								**0.012** **	
								(0.006)	
Liquid								-0.018	
								(0.015)	
Money								-0.004	
								(0.016)	
Comm/GDP									1.506
									(1.099)
Manuf/GDP									**2.492***
									(1.432)
Serv/GDP									1.473
									(1.178)
Observations	98	80	83	65	65	47	54	83	94
Pseudo R-squared	0.39	0.42	0.34	0.41	0.38	0.46	0.31	0.39	0.36

Note: Probit estimation results with clustering by country and robust standard errors in parenthesis. *, **, and *** indicate coefficients significant at 10%, 5%, and 1% level respectively. Controls from base regression included but coefficients omitted for brevity. Marginal effect estimate used in the standard deviation analysis take from specification (6) (highlighted).

Table 5: Takeoffs and financial flows, regional effects (dependent variable: realization of a takeoff).

	(1)	(2)
portfolio debt outflow	-0.035	-0.041
	(0.095)	(0.101)
portfolio debt inflow	**0.687*** **	**0.775*** **
	(0.260)	**(0.278)**
portfolio equity outflow	**-2.301** **	**-2.216** **
	(1.145)	**(1.078)**
portfolio equity inflow	**-0.520***	-0.495
	(0.301)	(0.312)
fdi outflow	**0.698***	**0.770** **
	(0.387)	**(0.354)**
fdi inflow	0.064	**0.142** **
	(0.042)	**(0.056)**
logpop		**-0.293***
		(0.162)
Latin America		**-0.470** **
		(0.213)
Sub-Saharan Africa		**-0.655*** **
		(0.236)
Asia		-0.183
		(0.278)
OECD		0.267
		(0.179)
portfolio equity outflow x Latin America	**-19.877** **	**-17.159*** **
	(9.350)	**(5.354)**
Observations	99	99
Pseudo R-squared	0.21	0.34

Note: Probit estimation results with clustering by country and robust standard errors in parenthesis. *, **, and *** indicate coefficients significant at 10%, 5%, and 1% level respectively. Controls from base regression included but coefficients omitted for brevity.

Table 6: Change in the takeoff probability due to a conditioning variable taking on its average value

	All	Latin America	Sub-Saharan Africa	Asia
portfolio debt outflow	0.59%	1.02%	0.02%	0.10%
portfolio debt inflow**	24.63%	13.92%	0.05%	33.47%
portfolio equity outflow**	11.02%	0.56%	0.27%	0.00%
portfolio equity inflow	-4.84%	-5.37%	-3.50%	0.04%
fdi outflow**	-21.55%	-2.32%	-4.53%	0.28%
fdi inflow *	23.15%	65.42%	9.23%	26.45%
short-term external debt**	-25.57%	-41.02%	-21.24%	-20.23%
change in CTOT***	-2.02%	-7.52%	1.97%	-12.19%

Note: Using coefficients from probit regression, the marginal contribution of each conditioning variable to the probability of *TO=1* is evaluate and the variable's subsample (*TO=0 & TO=1*) mean. We then multiply the value in equation (2) by the variable's sample average to evaluate its average association with the probability of a takeoff. *, **, *** indicate that the coefficient on the conditioning variable in the probit regressions was significant at the 10%, 5%, and 1% level respectively.

Table 7: Change in the takeoff probability due to one standard deviation rise in the conditioning variable

	All	Latin America	Sub-Saharan Africa	Asia
portfolio debt outflow	-3.51%	-4.15%	-0.11%	-0.22%
portfolio debt inflow**	71.06%	41.51%	0.99%	93.68%
portfolio equity outflow**	-46.96%	-6.13%	-9.93%	0.00%
portfolio equity inflow	-16.85%	-22.36%	-13.45%	-0.13%
fdi outflow**	62.31%	5.49%	12.94%	1.86%
fdi inflow *	75.46%	84.72%	18.70%	29.26%
short-term external debt**	-37.49%	-55.66%	-28.63%	-34.68%
change in CTOT***	28.36%	31.02%	30.66%	28.21%

Note: Using coefficients from probit regression, the marginal contribution of each conditioning variable to the probability of *TO=1* is evaluate and the variable's subsample (*TO=0 & TO=1*) mean. We then multiply the value in equation (2) by the variable's standard deviation to evaluate its economic impact on the probability of a takeoff. *, **, *** indicate that the coefficient on the conditioning variable in the probit regressions was significant at the 10%, 5%, and 1% level respectively. Used 0.5 standard deviations for FDI inflows in Latin American subsample for tractability.

Table 8: Change in the takeoff probability due to one standard deviation rise in the conditioning variable

	low country (sample average)		high country (plus 1 s.d.)		change in Pr(Takeoff)
	value (% GDP)	Pr(Takeoff)	value (% GDP)	Pr(Takeoff)	
portfolio debt outflow	Korea (1990)		Sri Lanka (1999)		
	-0.14	12.61%	0.66	1.02%	-11.59%
portfolio debt inflow**	South Africa (1991)		Thailand (1998)		
	0.25	49.01%	1.03	88.28%	39.27%
portfolio equity outflow**	Korea (1994)		Israel (1989)		
	-0.03	68.54%	0.11	8.06%	-60.48%
portfolio equity inflow	India (1993)		Ukraine (1999)		
	0.12	67.83%	0.39	18.48%	-49.35%
fdi outflow**	Turkey (2000)		Jordan (1994)		
	-0.18	40.01%	0.36	65.15%	25.14%
fdi inflow *	Mexico (1986)		Malaysia (1992)		
	1.24	26.04%	5.71	99.99%	73.96%
short-term external debt**	Mexico (1980)		Bolivia (1986)		
	5.52	27.31%	14.59	7.27%	-20.04%
change in CTOT***	Colombia (1969)		Chile (1983)		
	-1.70	16.56%	16.84	71.89%	55.33%

Notes: The last column of the table measures the difference in the predicted probability of a takeoff between specific countries whose values of conditional variables are approximately one standard deviation apart, with the lower value drawn close to the sample mean. This methodology is robust to the concavity in the shape of the cumulative probability distribution function.

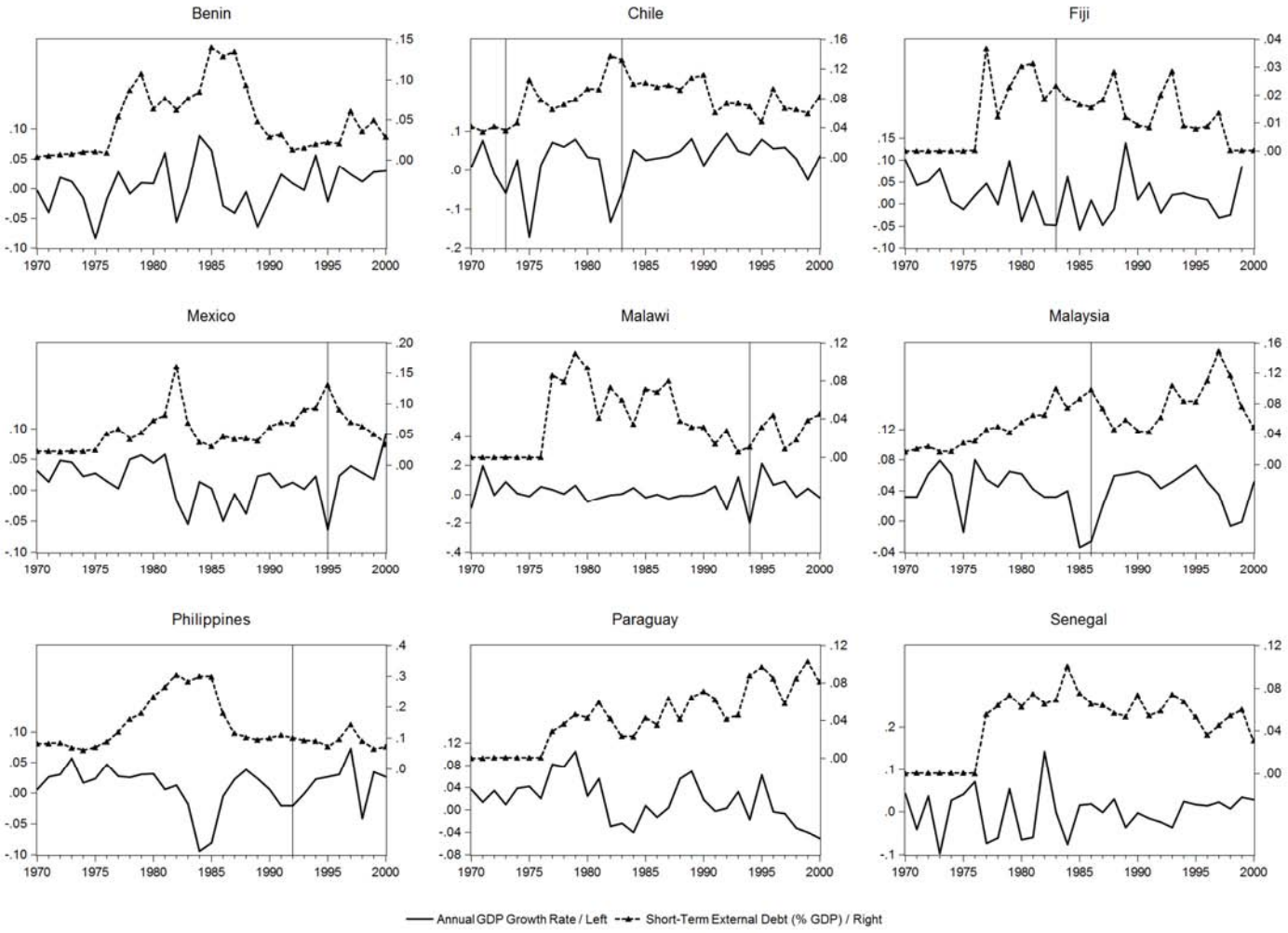
Table 9: Sustained takeoffs and financial flows (dependent variable: takeoff lasting 8 year or more)

	(1)	(2)	(3)	(4)	(5)	(6)
net portfolio debt inflow	**0.359***	**0.330***	**0.297****	**0.665*****	**0.899*****	**2.113****
	(0.191)	**(0.195)**	**(0.141)**	**(0.192)**	**(0.237)**	**(1.021)**
net portfolio equity inflow	**-1.649****	**-1.367***	-0.765	**-1.499***	**-2.256****	**19.731*****
	(0.831)	**(0.795)**	(0.501)	**(0.900)**	**(0.885)**	**(5.969)**
net fdi inflow	**-0.361*****	**-0.569*****	**-0.250****	**-0.674*****	**-0.694*****	**-0.602*****
	(0.140)	**(0.173)**	**(0.121)**	**(0.196)**	**(0.204)**	**(0.223)**
change in CTOT	**0.960***	**2.268****	**2.713****	**6.162*****	**9.394*****	1.273
	(0.538)	**(0.955)**	**(1.248)**	**(2.380)**	**(2.251)**	(0.842)
loggdp	0.13	0.006	-0.095	**-0.531****	**-0.815*****	
	(0.104)	(0.131)	(0.112)	**(0.260)**	**(0.294)**	
logpop	-0.037	**0.225****	-0.053	**0.169****	**0.220***	
	(0.053)	**(0.109)**	(0.034)	**(0.082)**	**(0.133)**	
openness		**1.835*****		**1.979*****	**2.897*****	
		(0.651)		**(0.510)**	**(0.958)**	
Latin America			-0.112	-0.29	**-0.441****	
			(0.085)	(0.261)	**(0.205)**	
Asia			0.073	-0.337	**-0.595****	
			(0.235)	(0.219)	**(0.261)**	
Sub-Saharan Africa			**-0.681*****	**-0.653*****	**-0.826*****	
			(0.185)	**(0.199)**	**(0.105)**	
regchange					**0.832*****	
					(0.187)	
short-term external debt						-0.029
						(0.019)
Observations	31	28	31	28	28	18
Pseudo R-squared	0.28	0.45	0.52	0.62	0.69	0.55

Note: Probit estimation results with clustering by country and robust standard errors in parenthesis. *, **, and *** indicate coefficients significant at 10%, 5%, and 1% level respectively. OECD dummy dropped due to collinearity.

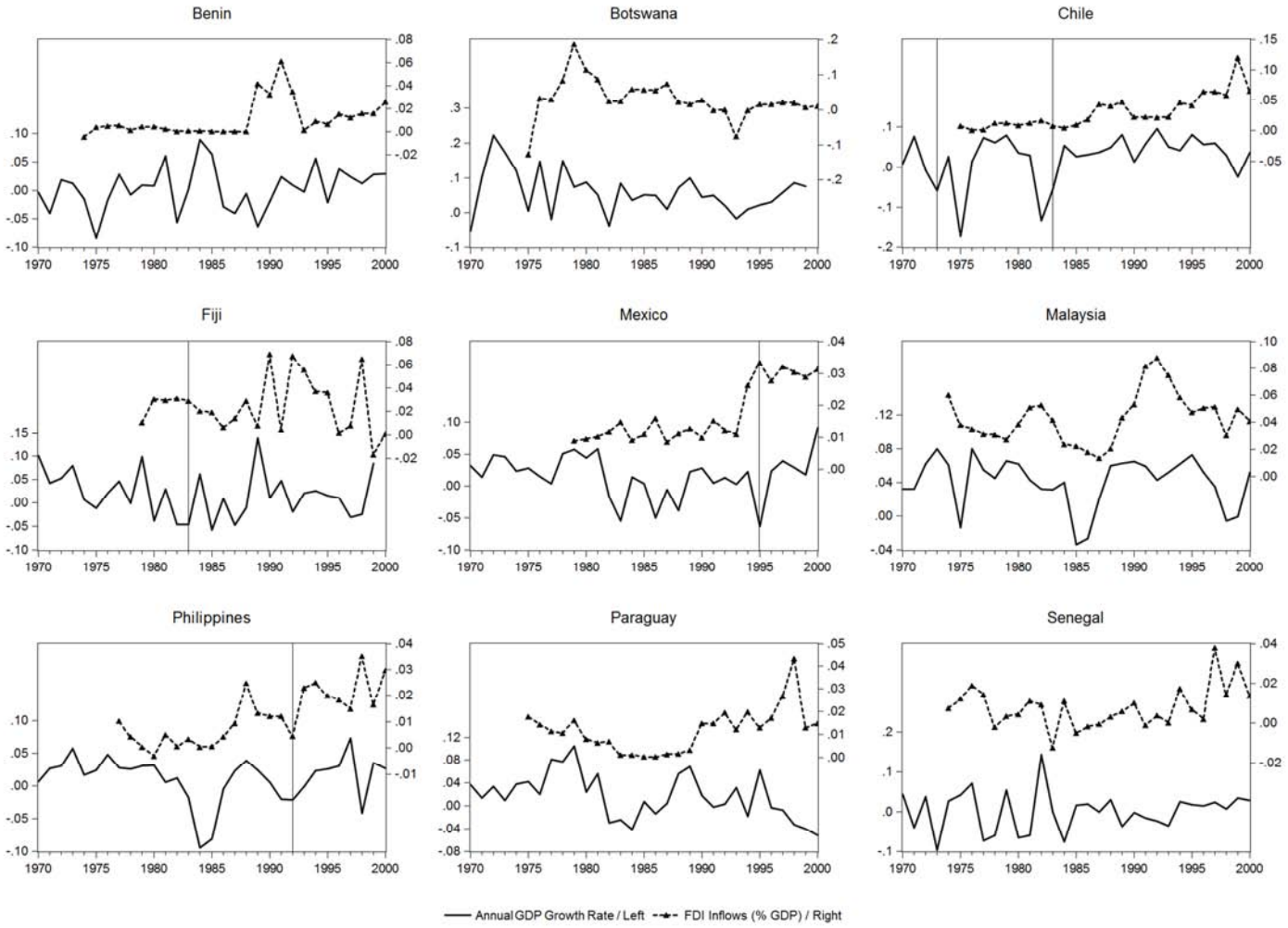
Figures

Figure 1: Economic growth and change in the stock of short-term external debt for selected countries.



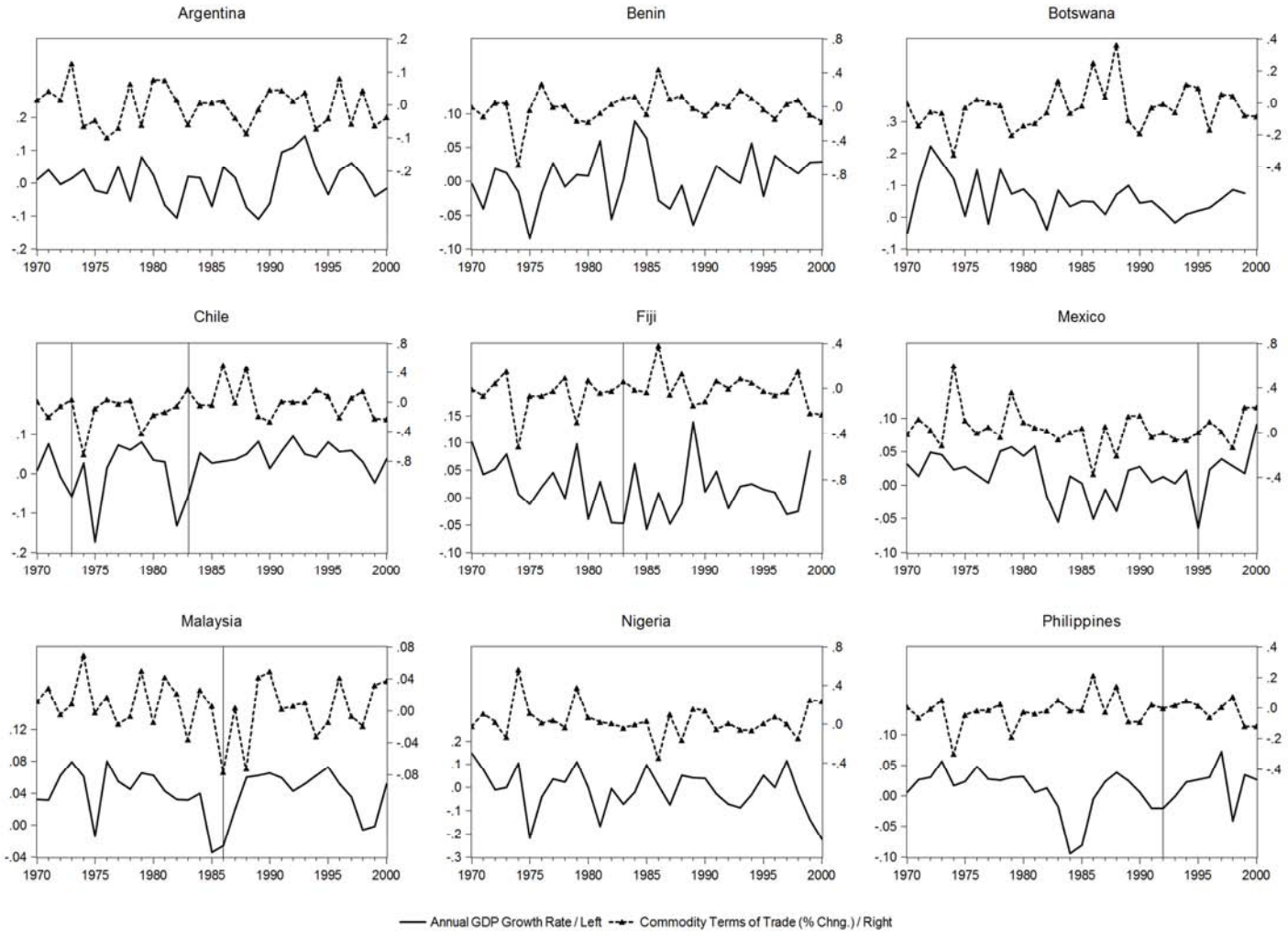
Notes: The figure corroborates negative association between economic growth and a country's stock of short-term external debt for selected countries (three from Caribbean-Latin America, East and South Asia, and Sub-Saharan Africa respectively). Takeoff episodes indicated with vertical bars.

Figure 2: Economic growth and FDI inflows for selected countries.



Notes: The figure corroborates positive association between economic growth and a country's FDI inflow for selected countries (three from Caribbean-Latin America, East and South Asia, and Sub-Saharan Africa respectively). Takeoff episodes indicated with vertical bars.

Figure 3: Economic growth and commodity terms of trade changes for selected countries.



Notes: The figure corroborates positive association between economic growth and a country's commodity terms of trade for selected countries (three from Caribbean-Latin America, East and South Asia, and Sub-Saharan Africa respectively). Takeoff episodes indicated with vertical bars.

Figure 4: Probit residuals from specification (2) in Table 3

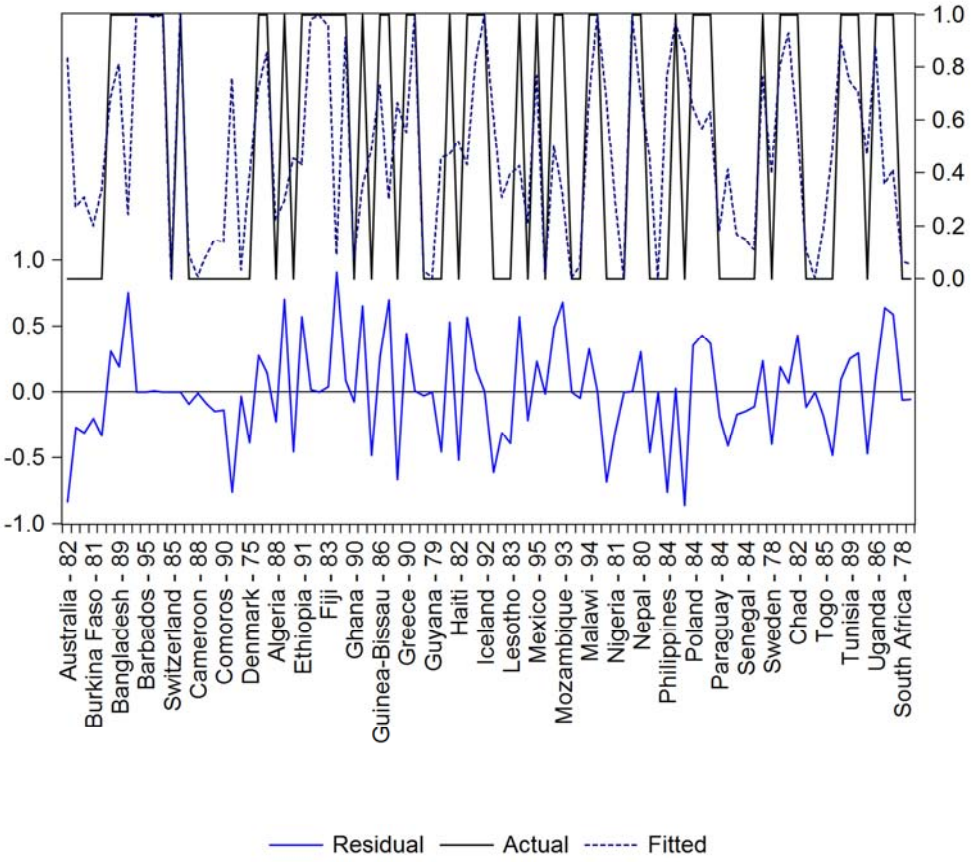
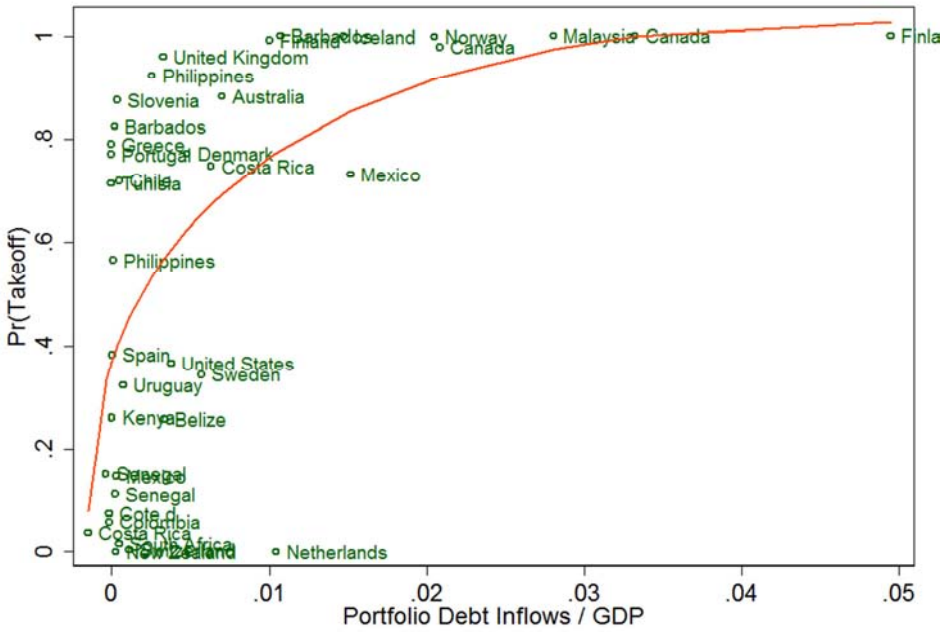
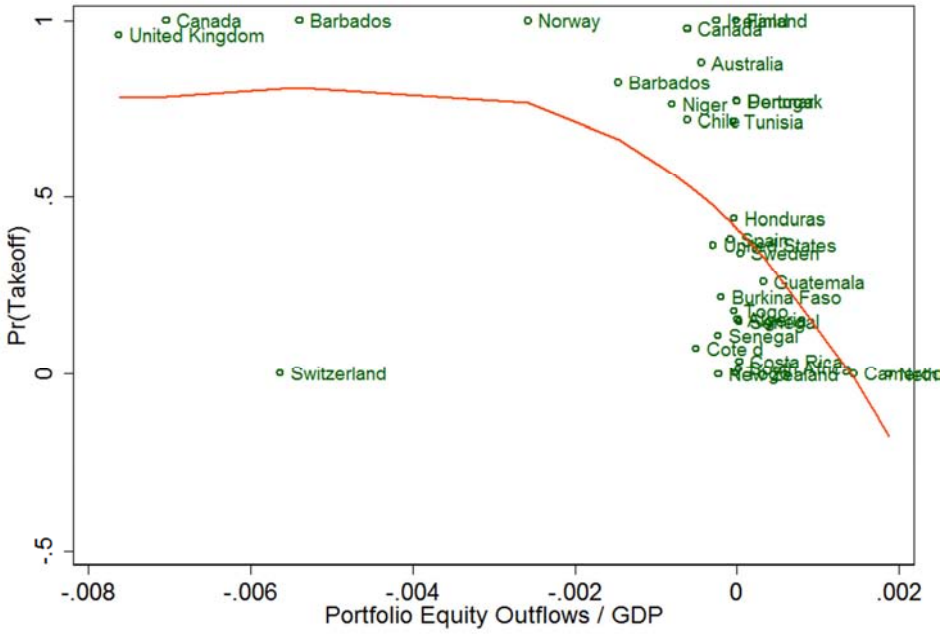


Figure 5: Predicted probability of a takeoff based on probit regression results and portfolio debt inflows.



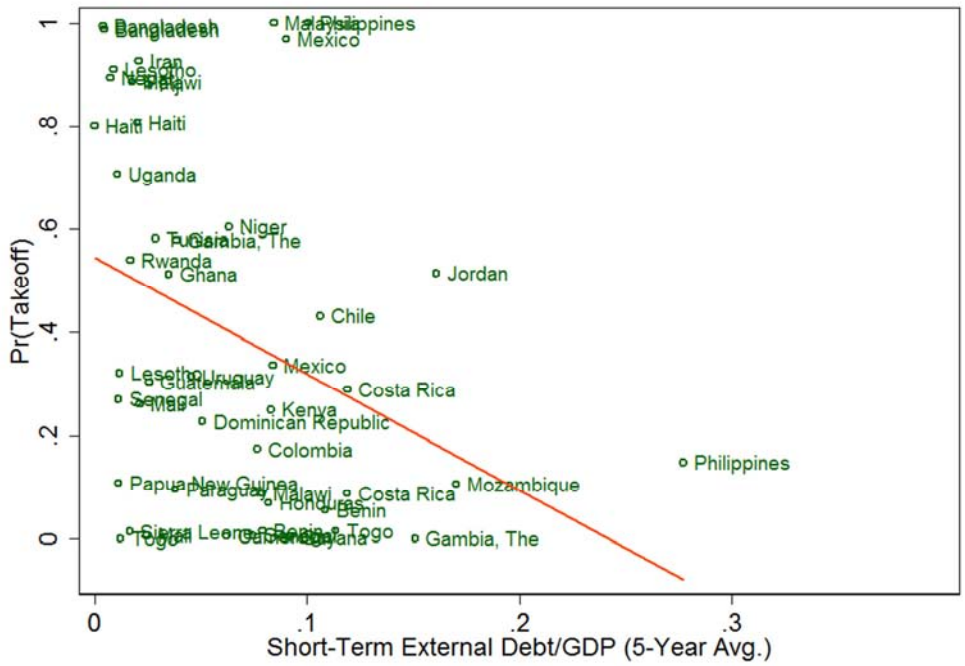
Notes: The figure shows the predicted probability of a takeoff based on probit regression results and portfolio debt inflows with fractional polynomial fit to the data.

Figure 6: Predicted probability of a takeoff based on probit regression results and port. equity outflows.



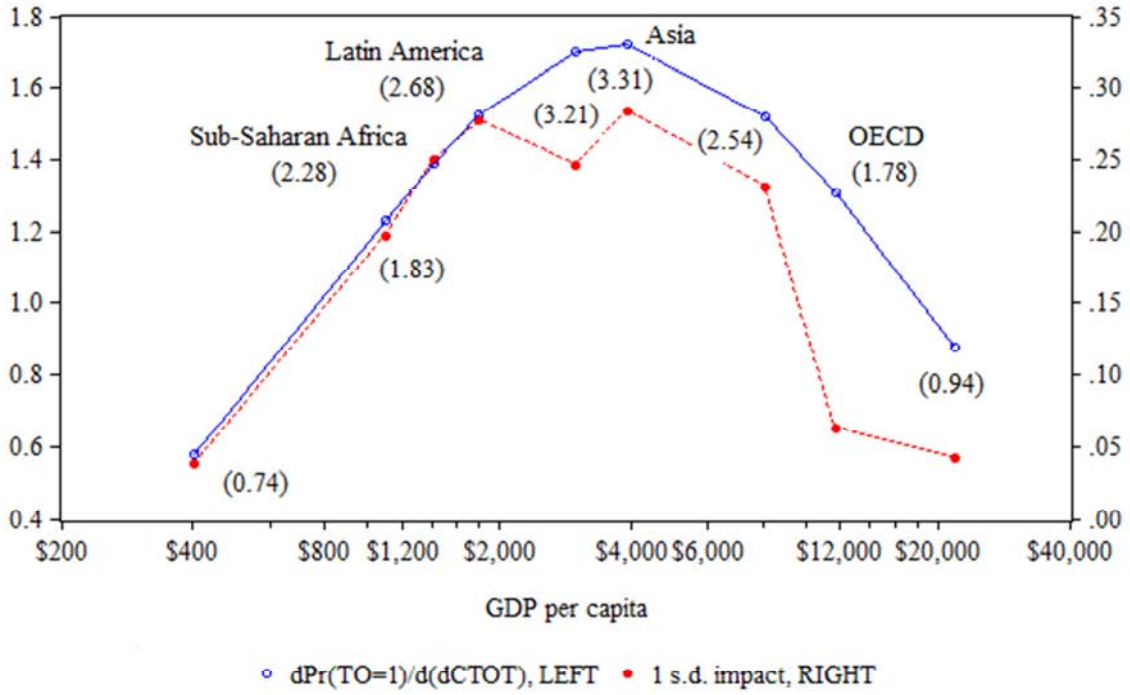
Notes: The figure shows the predicted probability of a takeoff based on probit regression results and portfolio equity outflows with fractional polynomial fit to the data.

Figure 7: Predicted probability of a takeoff based on probit regression results and short-term external debt.



Notes: The figure shows the predicted probability of a takeoff based on probit regression results and the stock of short-term external debt with best linear fit. The correlation coefficient is negative and significant at -0.2081*** (p-value = 0.000).

Figure 8: The effect of commodity terms of trade shocks on the probability of a takeoff for different income levels.



Notes: The figure depicts the income effect of commodity terms of trade shock for countries of different income levels. The income effect is proxied by the marginal effect of a positive commodity terms of trade shock on the on the probability of a takeoff. The left axis shows marginal effects estimated with baseline probit specification (2) at the given income level (horizontal axis, log scale); z-statistics of estimated coefficients in parentheses. Points of GDP per capita corresponding to subsamples averages of Sub-Saharan Africa, Latin America, Asia, and OECD are labeled accordingly. Marginal effect of approximately 1.7 for a country with GDP per capita of $4,000 (which is the subsample average for Asian countries) indicates that a 1 percent improvement in the commodity terms of trade is associated with a 1.6 percent higher predicted probability of economic takeoff. The right axis shows the product of the marginal effect coefficient and subsample standard deviation of dCTOT for each income range. For a country with income level of approximately $4,000 per capita a one standard deviation improvement in commodity terms of trade is associated with greater than 25 percent higher probability of a takeoff.

Appendix A

Table A1: Variable definitions and sources

Variable Name:	Definition:	Source:
portfolio debt in(out)flows	Debt security liabilities to nonresidents (market value, inflow) minus debt security assets (market value, outflow); %GDP	International Investment Position Data, International Financial Statistics, IMF
portfolio equity in(out)flow	Equity security liabilities to nonresidents (market value, inflow) minus equity security assets (market value, outflow); %GDP	
FDI in(out)flows	Direct investment in reporting economy (flow) minus direct investment abroad (flow); % GDP	
short-term external debt	Gross External Short-Term Debt of Central Gov't, Monetary Authorities, Banks, and Other Institutions; % GDP	Joint External Debt Hub (JEDH) database, joint IMF and the World Bank. Available for countries that subscribe to the IMF's Special Data Dissemination Standard (SDDS)
CTOT	$CTOT_i = \prod_j (P_j / MUV) X_j^i / \prod_j (P_j / MUV) M_j^i$ where j denotes one of the six commodity categories (food, fuels, agricultural raw materials, metals, gold, and beverages), Pj is the price index for each commodity, and *Xij* and *Mij* are the average shares of commodity j in country i's exports and imports respectively over the period 1980 through 2001. Commodity prices are deflated by the manufacturing unit value index (*MUV*).	Commodity prices are obtained from Commodity Price Database, IMF (http://www.imf.org/external/np/res/commod/index.asp). MUV is obtained from Global Economic Monitor Database, World Bank; Commodity export shares come from IMF data, see Lee, Milesi-Ferretti and Ricci (2008).
openness	Ratio of exports plus imports over GDP in local currency units	International Financial Statistics, IMF
tariff rate	Average annual tariff rate	Dollar-Kraay (2004) data
income level	log of real GDP per capita	Heston, Summers, and Aten (2009) Penn World Tables 6.3
population	log of population	
years of schooling	years of education in the population above the age of 25	Barro and Lee (1993) dataset
Comm/GDP	Commodities to GDP ratio	World Development Indicators (WDI), The World Bank
Manuf/GDP	Manufacturing to GDP ratio	
Serv/GDP	Services to GDP ratio	
DomCredit	Domestic credit GDP ratio	
Liquidity	Liquidt liabilities to GDP ratio	
Money	Money to GDP ratio	
Reg.Chng.	Political regime change indicator	Marshall-Jaggers (2002) Policy IV dataset
War End	Takes on a value of 1 if there has been a cessation of conflict within the previous 5 years and 0 otherwise	Singer and Small (2003) Correlates of War database
Civil War	Takes on a value of 1 if there has been a civil war within the previous 5 years and zero otherwise	
Leader Death	Takes on the value of 1 if a country's leader has died within the previous 5 years and 0 otherwise	Jones and Olken (2005) dataset

Notes: Portfolio debt, equity and FDI flows, and stock of short-term external debt to GDP ratios enter as 5-year averages prior to (and including) the takeoff year.

Table A2: Financial flows and stock of short-term external debt, starting observation by country.

Country	Year(s) of Takeoff	Portfolio Debt	Portfolio Equity	FDI	Short-Term Ext. Debt
Angola		1996	1996	1996	1996
Albania		1992 (1998)	1992	1992	1992
Argentina	1963	1989	1989	1989	1989
Armenia		1996	1996	1998	1994
Antigua	1995	1977 (1994)	1977 (1994)	1977	
Australia		1960	1960	1960	
Austria		1967	1967	1967	
Azerbaijan		1995		1995	1995
Burundi	1980	1985	1985	1985	1970
Belgium	1985				
Benin		1974	1974	1974	1970
Burkina Faso	1972	1974	1974	1974	1970
Bangladesh	1979, 1989	1976	1976	1976	1973
Bulgaria		1992	1992	1992	1991
Belarus	1995	1996	1997	1997	1995
Belize	1985	1984	1984	1984	1973
Bolivia	1960, 1968	1985	1985	1985	1985
Brazil		1993	1993	1993	1993
Barbados	1984, 1995	1970	1970	1970	
Botswana	1965	1975	1975	1975	1970
Central African Republic		1977	1977	1977	1970
Canada	1960, 1991	1950	1950	1950	
Switzerland		1977	1977	1983	
Chile	1973, 1983	1975	1975	1975	1970
China	1961, 1971	1982	1982	1982	1981
Cote d`Ivoire		1975	1975	1975	1970
Cameroon	1965	1977	1977	1977	1970
Congo, Republic of	1967	1978	1978	1978	1970
Colombia		1968	1968	1968	1970
Comoros		1983 (1999)	1983 (1999)	1983 (1999)	1970 (1999)
Cape Verde	1965, 1974	1977 (1996)	1977 (1996)	1977	1981
Costa Rica	1963	1977	1977	1977	1970
Cuba					
Cyprus	1960, 1975	1976	1976	1976	
Czech Republic		1993	1993	1993	
Dominica		1976 (1994)	1976 (1994)	1976	1981
Denmark	1981	1975	1975	1975	
Dominican Republic	1965, 1986	1968	1968 (1996)	1968	1970
Algeria	1970	1977 (1995)	1977 (1995)	1977 (1995)	
Ecuador	1966				
Egypt	1974	1977	1977	1977	1970
Spain	1979	1975	1975	1975	
Estonia		1993	1993	1993	
Ethiopia	1991	1977 (1998)	1977 (1998)	1977 (1998)	1970
Finland	1978, 1992	1975	1975	1975	
Fiji	1965, 1983	1979	1979	1979	1970
France		1975	1983	1975	
Gabon	1981	1978	1978	1978	1970
United Kingdom	1981	1970	1970	1970	
Germany		1971	1971	1971	
Ghana	1960	1985	1985	1985	1985
Guinea					
Gambia, The	1979	1978 (1998)	1978 (1998)	1978 (1998)	1970
Guinea-Bissau	1966, 1992	1986 (1997)	1986 (1997)	1986 (1997)	1986
Equatorial Guinea	1965	1987	1987	1987	
Greece	1990	1976	1976	1976	
Grenada	1994	1977 (1994)	1977 (1994)	1977	1973
Guatemala		1977	1977 (1998)	1977 (1998)	1970
Guyana	1960, 1992	1977	1977 (1989)	1977 (1989)	1970
Hong Kong		1998	1998	1998	
Honduras	1970	1974	1974	1974	1970
Haiti	1972	1971	1971	1971	1970
Hungary	1990	1982	1982	1982	
Indonesia	1965	1981	1981 (1998)	1981	1970
India	1966, 1974	1975	1975	1975	1970
Ireland		1974	1974	1974	
Iran	1987	1976	1976	1976	1971
Iceland	1960, 1992	1976	1976	1976	
Israel	1967	1980	1980	1980	
Italy		1970	1970	1970	
Jamaica		1976	1976	1976	1970
Jordan	1969	1972	1972	1972	1970
Japan		1977	1977	1977	

Note: The first column indicates the year(s) in which a country experienced an economic takeoff. If observations on financial controls end prior to the year 2000, the ending year is indicated in parentheses.

Table A2 (Cont'd): Financial flows and stock of short-term external debt, starting observation by country.

Country	Year(s) of Takeoff	Portfolio Debt	Portfolio Equity	FDI	Short-Term Ext. Debt
Kazakhstan		1995	1997	1995	1994
Kenya	1961, 1970	1975	1975	1975	1970
Kyrgyzstan		1995	1998	1998	1994
Cambodia		1998	1998	1998	1990
St. Kitts & Nevis		1980 (1994)	1980 (1994)	1980	1984
Korea, Republic of	1960	1976	1976	1976	
Lebanon					1970
St. Lucia		1986 (1995)	1976 (1995)	1976	1981
Sri Lanka	1974	1975	1975	1975	1970
Lesotho	1969, 1990	1975 (1998)	1975 (1998)	1975 (1998)	1970
Lithuania		1994	1993	1995	1993
Luxembourg	1977				
Latvia	1995	1996	1993	1992	
Macao					
Morocco	1960	1975	1975	1975	1970
Madagascar		1974 (1994)	1974 (1994)	1974 (1999)	1970
Mexico	1995	1979	1979	1979	1970
Macedonia					
Mali	1973, 1993	1975	1975	1975	1970
Mozambique	1966, 1993	1980	1980	1980	1984
Mauritania		1975	1975	1975	1970
Mauritius	1960, 1968	1976	1976	1976	1970
Malawi	1960, 1994	1977	1977	1977	1970
Malaysia	1986	1974	1974	1974	1970
Namibia		1990	1990	1990	
Niger		1974	1974	1974	1970
Nigeria	1965	1977	1977	1977	1970
Nicaragua	1960	1990	1990	1990	1990
Netherlands		1967	1967	1967	
Norway	1991	1975	1975	1975	
Nepal	1980	1976	1976	1976	1970
New Zealand	1968	1972 (1995)	1972 (1995)	1972	
Pakistan	1960	1976	1976	1976	1970
Panama	1976, 1987	1977	1977	1977	1970
Peru	1961	1991	1990	1991	1990
Philippines	1992	1977	1977	1977	1970
Papua New Guinea	1970, 1988	1976	1976	1976	1970
Poland	1984, 1990	1981	1981	1981	
Portugal	1978	1975	1975	1975	
Paraguay		1975	1975	1975	1970
Romania	1980	1991	1991	1991	
Russia		1994	1994	1994	1993
Rwanda	1965, 1974	1976	1976	1976	1970
Senegal		1974	1974	1974	1970
Singapore		1972	1972	1972	
Sierra Leone	1967, 1973	1977	1977	1977	1970
El Salvador	1960				
Sao Tome and Principe	1980, 1986				
Slovak Republic	1992	1994	1993	1993	
Slovenia	1995	1992	1992	1992	
Sweden		1970	1970	1970	
Seychelles	1965	1976	1976 (1992)	1976	1980
Syria	1967, 1989	1977	1977	1977	1995
Chad	1982	1977 (1998)	1977 (1998)	1977 (1998)	1970
Togo	1971	1974	1974	1974	1970
Thailand		1975	1975	1975	1970
Trinidad &Tobago	1971, 1992	1975 (1998)	1975 (1999)	1975	
Tunisia	1989	1976	1976	1976	1970
Turkey	1962	1992	1992	1992	1992
Taiwan					
Tanzania	1980	1976	1976	1976	1970
Uganda	1973, 1986	1981	1981	1981	1981
Ukraine		1994	1996	1994	1993
Uruguay	1974, 1983	1978	1978	1978	1978
United States	1960, 1982	1970	1970	1970	
St.Vincent & Grenadines		1978	1978	1978	1975
Venezuela	1961	1984	1984	1984	1984
Vietnam				1996	1989
Yemen		1998	1990	1998	1990
South Africa		1950	1950	1950	1994
Congo, Dem. Rep.					
Zambia		1978	1978	1978	1970
Zimbabwe	1962, 1977	1992	1992	1992	1992

Note: The first column indicates the year(s) in which a country experienced an economic takeoff. If observations on financial controls end prior to the year 2000, the ending year is indicated in parentheses.